

Central University of Finance and Economics
School of Economics
Intermediate Microeconomics, Fall 2017
Homework 2
(Due Date: Friday, December 29, 2017)

Question 1. (15 points)

Suppose that there is a single producer in the market, with the following total cost function $TC(Q) = \frac{Q^2}{2} + 10Q + 20$, the demand for the market is given by $Q = 100 - P$.

- a) Calculate the marginal revenue (MR), marginal cost (MC), and the average cost (AC).
- b) Assuming that this firm behaves competitively, find the equilibrium price, the quantity of the firm, and its profits.
- c) Suppose that the firm act instead as a monopolist, find the equilibrium output and price and calculate the firm's profit.

Question 2. (15 points)

Consider a firm that produces sweaters using two inputs: capital K (in machine hours) and labor L (in hours). The production function is $Y = K^{1/2}L^{1/2}$. The input prices this firm faces are $r=4$ and $w=36$, where r is the cost of capital and w is the wage. Suppose the firm expects to produce $Y=300$ units of output.

- a) Calculate the cost minimizing inputs. What is the total cost of production, and what is the average cost per unit of output?

Suppose the output target unexpectedly rises to 450 units after the capital has been installed.

- b) In the short run the capital stock is fixed and cannot be changed. What is the firm's short-run production function? Does it display increasing returns to scale, constant returns to scale, or decreasing returns to scale?
- c) What amount of labor should the firm use to produce the 450 units at minimum costs? What are the variable costs of production? What are total costs? What is the cost per unit?

Question 3. (20 points)

Assuming that Americans' demand for beef is: $D(p) = 12 - 2p$. Beef comes from both Canadian and US producers. Their supplies functions are $S_C(p) = 0.5p$ and $S_{US}(p) = 0.5p$. (Assume that all Canadians are vegetarian and the price of beef in Canada is zero.)

- a) Find the total supply function in the US if Canadian producers are allowed to sell in the US.
- b) In that case, what is the perfect competitive equilibrium price and quantity?
- c) What are the consumer surplus, Canadian producer surplus, US producer surplus and dead weight loss?
- d) US beef producers complain that cheap beef from Canada is destroying their livelihood and lobby Congress to pass a ban on Canadian beef called "The

- Patriotic Beef Act”. What would the equilibrium be if Congress passes the ban?
- e) What are the consumer surplus, Canadian producer surplus, US producer surplus and dead weight loss? Who wins and who losses from the ban? Is the ban beneficial for the US as a whole?

Question 4. (20 points)

Consider the following inverse demand equation: $p=a-bq$ and assume the total cost function is $TC(q)=cq$.

- a) Set up the monopolist’s problem as a profit maximization problem and calculate the profit maximizing output.
- b) Suppose there is a **profit tax** t_p levied on this monopolist, show that the profit maximizing output is still the same as in a).
- c) Suppose there is a **quantity tax** t_q so that the total cost function becomes $TC(q)=(c+t_q)q$, calculate the profit maximizing output.
- d) Suppose now there is a **revenue tax** t_r levied on this monopolist, calculate the profit maximizing output.
- e) Prove that when t_q and t_r satisfy $c+t_q = \frac{c}{1-t_r}$, there is equivalence between

revenue tax and quantity tax in the sense that the monopolist will produce the same level of output under quantity tax and revenue tax.

Question 5. (30 points)

Suppose that a firm has the following technology to produce the good y :

$$y = f(L, K) = \min \left\{ \frac{L}{\alpha_L}, \frac{K}{\alpha_K} \right\}$$

The prices of inputs are $w=1$ and $r=5$.

- a) What is the meaning of the parameters α_L and α_K ?
- b) Does this production function exhibit increasing, decreasing or constant returns to scale? Prove your answer.
- c) Derive the firm’s long-run total cost curve ($TC(y)$), long-run average cost curve ($AC(y)$), and the long-run marginal cost curve ($MC(q)$).
- d) Plot the three curves on the same graph by assuming $\alpha_L=4$, $\alpha_K=2$.
- e) Now suppose that in the short-run, the capital is fixed at $K=10$ and $\alpha_L=4$, $\alpha_K=2$. Derive the firm’s short-run total cost curve ($TC(y)$) the short-run average cost curve ($AC(y)$), and the short-run marginal cost curve ($MC(q)$).
- f) Plot the three curves on the same graph.